A 24-YEAR COMPARISON OF THE VEGETATION OF AN ADIRONDACK MOUNTAIN SUMMIT

E. H. KETCHLEDGE AND R. E. LEONARD

ABSTRACT

A permanent 300-foot triangular transect was installed by H. E. Woodin in 1957 immediately above timberline on the isolated west slope of the summit cone of Mount Marcy, elevation 5334 feet, highest peak in the Adirondack Mountains of northern New York State. Re-measurement of the transect in 1981 revealed only slight change in either the floristic composition of the transect or in the percentage of arctic species present. Minor differences in data appear to be caused by different personnel performing the measurements or by sampling error inherent in the line-intercept procedures.

Key Words: Adirondack Mountains, permanent transect, arctic species

The value of permanent vegetation sampling sites for long-term ecological studies is increasingly evident; their importance is particularly great in evaluating the impact of recreation upon the natural environment. Fragile ecosystems such as alpine meadows are often subject to intense trampling by hikers visiting scenic summits. More recently, vegetational stability of alpine peaks in the northeast is of concern because of increasing evidence of vegetational damage due to acid deposition, especially in the high-elevation spruce-fir forests of New York and New England. In the Adirondack Mountains, the only permanent study site designed for alpine investigations was established by H. E. Woodin (Woodin, 1959) on Mount Marcy, el. 5334 ft., highest peak in the region. Woodin selected an isolated section of the 15-acre open summit zone extending above timberline on the unfrequented western slope of the peak, far from the public hiking trail and thus free from trampling by summit visitors. The transect, an equilateral triangle 100 feet on a side and spanning the elevations of 4,958 ft. to 4,984 ft., was intended to allow "future investigators to determine whether timberlines in the eastern United States are ascending or descending". The transect now serves equally well as a baseline for studies of vegetational stability in general. In 1981, we remeasured the transect to ascertain any floristic changes or vegetational shifts that may have occurred over the past twenty-four years.

Comparison of the data from 1957 with those of 1981 (Table 1) showed little change in either flora or vegetation along the transect during the 24-year period. Minor differences are attributable to sampling error inherent in use of a line-intercept procedure in a floristically diverse community which contained approximately ninety-three species of vascular plants. Similarly, some variation can be expected whenever different personnel remeasure the same population. The most striking result was the apparent absence of significant change in the virgin alpine meadow when contrasted with the severe deterioration observed along the public hiking trail several hundred feet upslope and out of sight of the study area.

FLORISTIC CHANGES

We note two additions to the list of species. *Trientalis borealis* was a single plant. The species is frequent in the krummholz transition into the spruce-fir zone downslope but is rarely successful on the wind-swept open summit. The occurrence of *Vaccinium boreale* is not unexpected either. Its presence in the alpine zone of the Adirondacks was first pointed out to us over fifteen years ago by the late Stanley Jay Smith, Senior Curator, New York State Herbarium, Albany, who identified the 1957 plants for Dr. Woodin. Currently we have records for the species from seven alpine summits and from five exposed stations at lesser elevations in New York State. We report also that *Vaccinium myrtilloides* and *V. angustifolium* occur sporadically near the timberline in the Adirondack high country.

We are uncertain of the significance of absence of the Mountain Alder and Cordate Birch from the 1981 data. The alder covered eleven inches in 1957 and was likely a single plant. The birch, however, which covered forty-one inches, may have been two or more plants. Both species are still present in the transect area but neither had branches intercepting a vertical projection through the intercept line. Plants nearby seemed otherwise healthy and vigorous at the time of measurement.

VEGETATIONAL SHIFTS

The living plant cover decreased 1.43% during the 24-year period, from 77.67% in 1957 to 76.24% in 1981. This minor shift may be

Table 1. Comparison of 1957 and 1981 permanent transect line-intercept data on Mt. Marcy.

	1957 (data of Woodin, 1959)		1981	
Species Recorded	Inches	Cover	Inches	Cover
SPHAGNACEAE				
Sphagnum pylaesii Brid.*	25	0.69%	110	3.05%
Sphagnum spp.	80	2.22	95	2.64
ANDREAEACEAE				
Andreaea rupestris Hedw.	42	1.16	75	2.08
GRIMMIACEAE				
Racomitrium spp.	55	1.53	2	0.06
Other Bryophytes & Lichens**	113	3.14	95	2.63
LYCOPODIACEAE				
Lycopodium annotinum L. var. *pungens* Desv.***	5	0.14	1	0.03
Lycopodium selago L.	7	0.19	10	0.28
PINACEAE				
Abies balsamea (L.) Mill.	210	5.83	257	7.14
Picea mariana (Mill.) BSP.	280	7.77	374	10.39
CYPERACEAE				
Carex bigelowii Torr.	8	0.25	16	0.44
Scirpus caespitosus L.	290	8.05	268	7.44
BETULACEAE				
Alnus viridis (Ait.) Pursh ssp. *crispa* (Ait.) Turrill	11	0.31	0	0.00
Betula cordifolia Regel	41	1.14	0	0.00
CARYOPHYLLACEAE				
Minuartia groenlandica (Retz.) Ostenf.	7	0.19	4	0.11
ROSACEAE				
Potentilla tridentata Solander ex. Ait.	67	1.86	7	0.19
EMPETRACEAE				
Empetrum nigrum L.	85	2.36	63	1.75
CORNACEAE				
Cornus canadensis L.	6	0.17	10	0.27

Table 1. Continued

Species Recorded	1957 (data of Woodin, 1959) Inches	Cover	1981 Inches	Cover
ERICACEAE				
Chamaedaphne calyculata (L.) Moench	18	0.50	66	1.84
Kalmia polifolia Wang.	16	0.44	15	0.42
Ledum groenlandicum Oeder	110	3.06	43	1.19
Vaccinium boreale Hall & Aalders	0	0.00	6	0.17
Vaccinium oxycoccus L.	5	0.14	13	0.36
Vaccinium uliginosum L.	1241	34.47	1107	30.75
DIAPENSIACEAE				
Diapensia lapponica L.	78	2.16	107	2.97
PRIMULACEAE				
Trientalis borealis Raf.	0	0.00	1	0.03
DEAD LEAF LITTER	--	---	125	3.47
BARE SOIL	93	2.58	81	2.25
BARE ROCK	706	19.61	649	18.02
Totals	3600	99.96%	3600	99.98%

*Nomenclature of bryophytes follows Ketchledge, 1980.

**Includes 113 inches of lichens missing by printers' error from Woodin, 1959, but subsequently supplied to us (personal correspondence, Woodin, 1982).

***Nomenclature of vascular plants follows Kartesz, John T. and Rosemarie Kartesz, 1980.

attributed either to sampling error or to our recognition of a new cover category, Dead Leaf Litter, which was visible through discontinuities in the living plant canopy. Whatever the cause, the shift is too slight to indicate major vegetational change.

On the other hand, the 2.36% increase in *Sphagnum pylaesii* and 1.59% decrease in Bare Rock is in our opinion, a notable shift. Our observations of the ecology of summit bryophytes, begun in 1949, repeatedly demonstrate the pioneering nature of *Sphagnum pylaesii* spreading over the wet bedrock wherever water seeps out from the vegetational mat. Lateral expansion of the vascular plant community on the open Adirondack summits is mediated by the *Sphagnum* mat which engulfs other bryophytes and in time provides a substrate permitting the establishment of herbaceous and woody plants.

The lateral spread of branches of the two nano-phanaerophytes, *Picea mariana,* up 2.6%, and *Abies balsamea,* up 1.31%, seemed to be at the expense of their chief canopy competitor, *Vaccinium uliginosum,* down 3.72%. These three species characteristically occur in intermixtures where the upward growth of spruce and fir is truncated every two or three years by winter-killing above the protecting snow field. The basal branches of spruce, less so fir, may slowly grow outward many feet, whereas the central trunks are ecologically restricted to a height of one or two feet; some of these dwarfed trees, we find, are over 200 years old.

ARCTIC VS. NON-ARCTIC SPECIES

Woodin considered only four species found along the transect to be "non-arctic": *Cornus canadensis, Abies balsamea, Betula cordifolia* and *Carex bigelowii.* He suggested future investigators should note any change in arctic vs. non-arctic percentages and should evaluate the invasion or loss of species on the transect. Using his criteria, non-arctic species totalled 7.66% cover in 1957 and 7.85% in 1981. We do not agree, however, with Dr. Woodin's inclusion in the "arctic" category of a number of species which reach their greatest abundance and vigor in non-arctic environments at lower elevations but which also survive in lesser numbers in alpine situations. We place the following additional summit species in that non-arctic category: *Picea mariana, Alnus viridis* ssp. *crispa, Chamaedaphne calyculata, Kalmia polifolia, Ledum groenlandicum, Vaccinium oxycoccus* and *Trientalis borealis.* On this revised basis, the non-arctic plants totalled 19.88% in 1957 and 22.08% in 1981, an increase of 3.20% during a quarter century.

The apparent stability over time of the virgin, alpine community on Mount Marcy stands in sharp contrast to the severe damage occurring along public hiking trails elsewhere on this peak.

ACKNOWLEDGMENTS

We gratefully acknowledge the assistance of Dixie Sipher in data analysis and Debbie Berrier and Jean Ketchledge in preparation of the manuscript. We particularly thank Dr. Woodin for supplying us with the lichen data inadvertently omitted from his 1959 report.

LITERATURE CITED

KARTESZ, JOHN T. & ROSEMARIE KARTESZ. 1980. A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland. Volume II, The Biota of North America. The University of North Carolina Press, Chapel Hill. 498 pp.

KETCHLEDGE, EDWIN H. 1980. Revised Checklist of the Mosses of New York State. New York State Museum Bulletin No. 440. Albany. 19 pp.

WOODIN, H. E. 1959. Establishment of a Permanent Vegetational Transect Above Timberline on Mt. Marcy, New York. Ecology 40: 320–322.

E. H. K.
DEPARTMENT OF ENVIRONMENTAL & FOREST BIOLOGY
SUNY COLLEGE OF ENVIRONMENTAL SCIENCE & FORESTRY
SYRACUSE, NY 13210

R. E. L.
USDA FOREST SERVICE
FORESTRY SCIENCES LABORATORY
PO BOX 640
DURHAM, NH 03824